

# Development of Axial Compressor Heat-Extraction Capability for Thermal Management Applications, Phase I

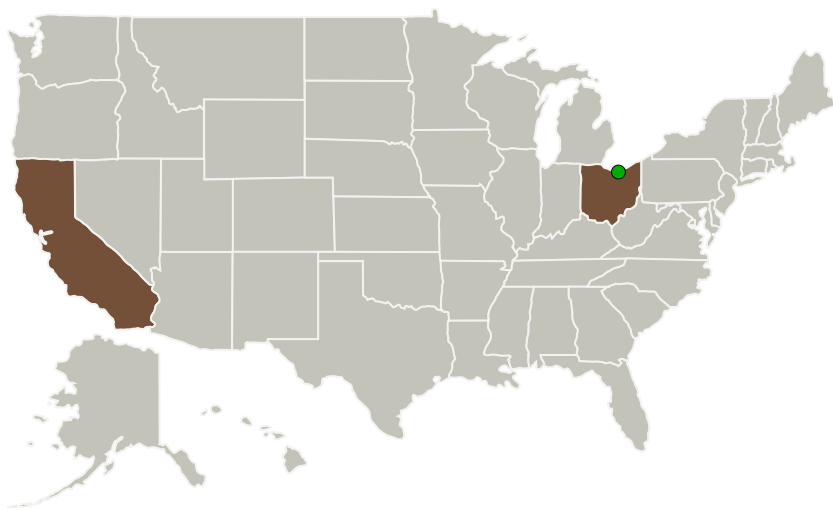
Completed Technology Project (2011 - 2011)



## Project Introduction

ATA Engineering, Inc. (ATA) proposes a small business innovation research (SBIR) program for a novel compressor heat-extraction development program in response to NASA's solicitation for advanced design concepts to enable increased high stage loading in single and multi-stage axial compressors while maintaining or improving aerodynamic efficiency and operability. The 'compressor cooling' development program proposed herein will be applicable to advanced turbomachinery based combined cycle (TBCC) propulsion systems suitable for high Mach number flight vehicles that extend to the hypersonic range as well as to conventional high bypass ratio (HBPR) engines that operate with high compressor exit temperatures. Cooling in the rear stages of a compressor would improve mass flow capability, increase margins set by material temperature limits, and improve turbine blade cooling effectiveness by reducing bleed air temperatures. The Phase I proposal technical objectives are to 1) estimate the system level benefit of compressor heat extraction for a mutually agreed-on TBCC-powered aircraft mission, 2) understand the fluid dynamics of flows with surface heat extraction in a multistage compressor using computational fluid dynamics, and 3) define the necessary validation steps on cascade and compressor component rig hardware to advance the technology readiness level of compressor cooling to the point where it may be implemented in an aircraft engine application. The final deliverable will be a written report to NASA presenting a conceptual design of a cooled compression system and a proposed test plan for Phase II rig validation, based on the requirements set forth in a design specification that is defined at the beginning of the program.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
ATA Engineering, Inc.	Lead Organization	Industry	San Diego, California
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

## Project Transitions

▶ **February 2011:** Project Start

✓ **September 2011:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138095>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

ATA Engineering, Inc.

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

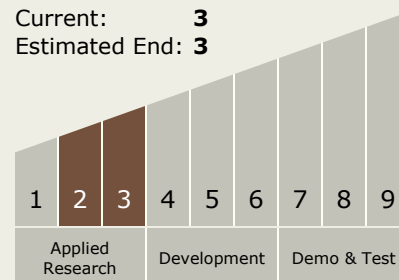
Carlos Torrez

## Principal Investigator:

Parthiv N Shah

## Technology Maturity (TRL)

Start: 2  
Current: 3  
Estimated End: 3



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## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.1 In-space Propellant Storage & Utilization

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System